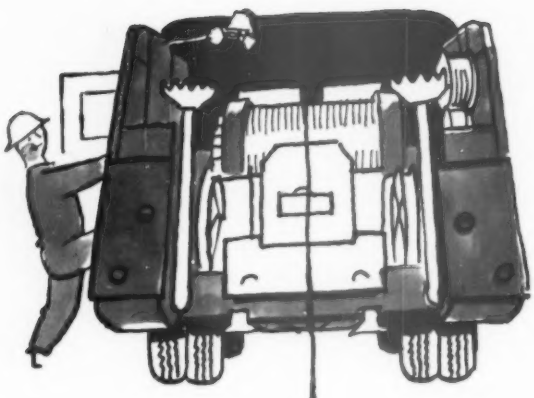
JOURNAL OF Petroleum Technology

AUGUST, 1953



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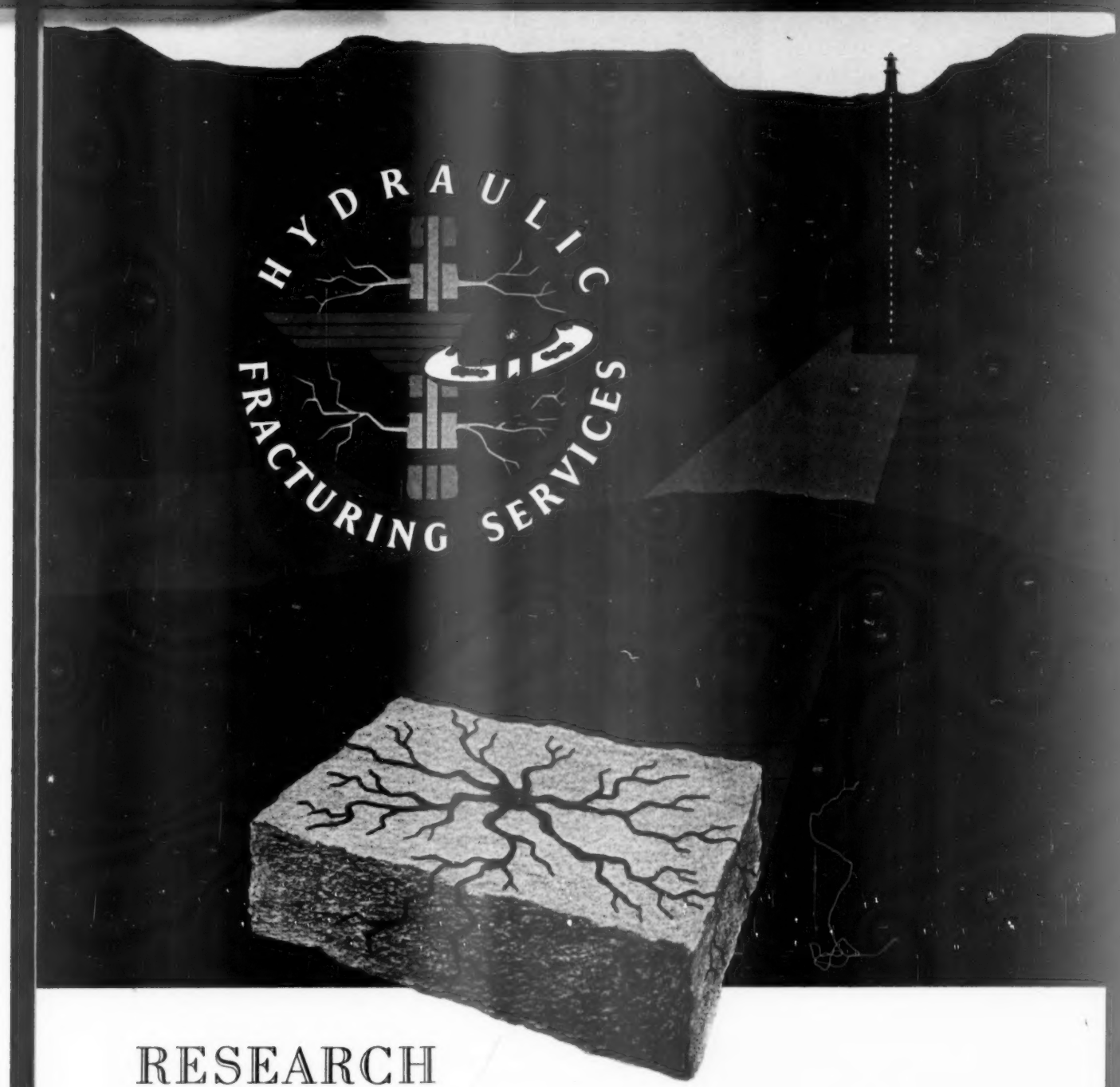

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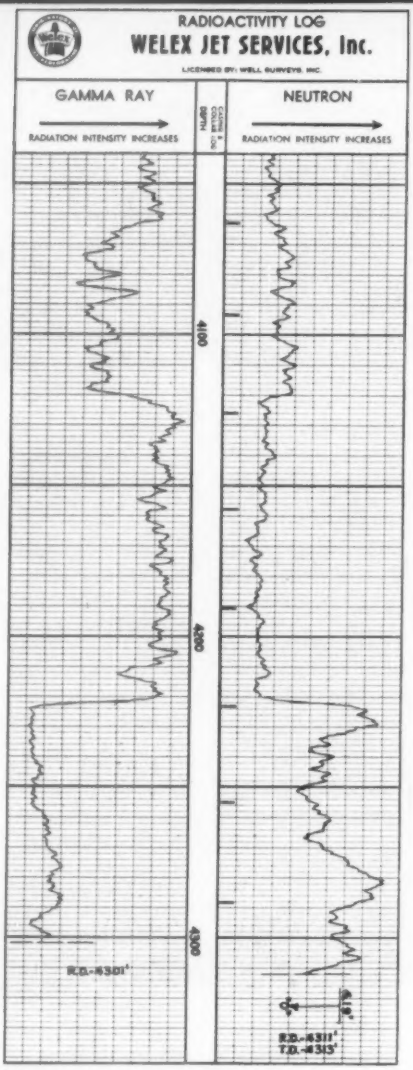

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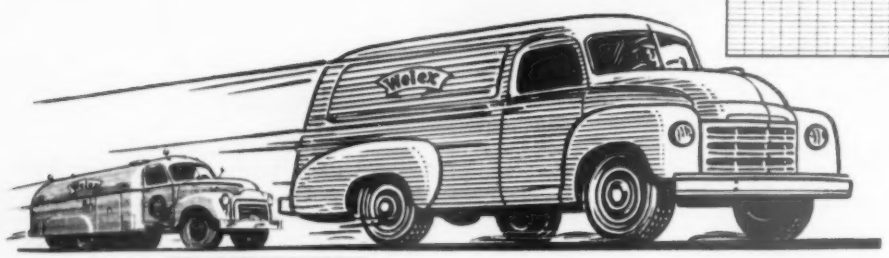

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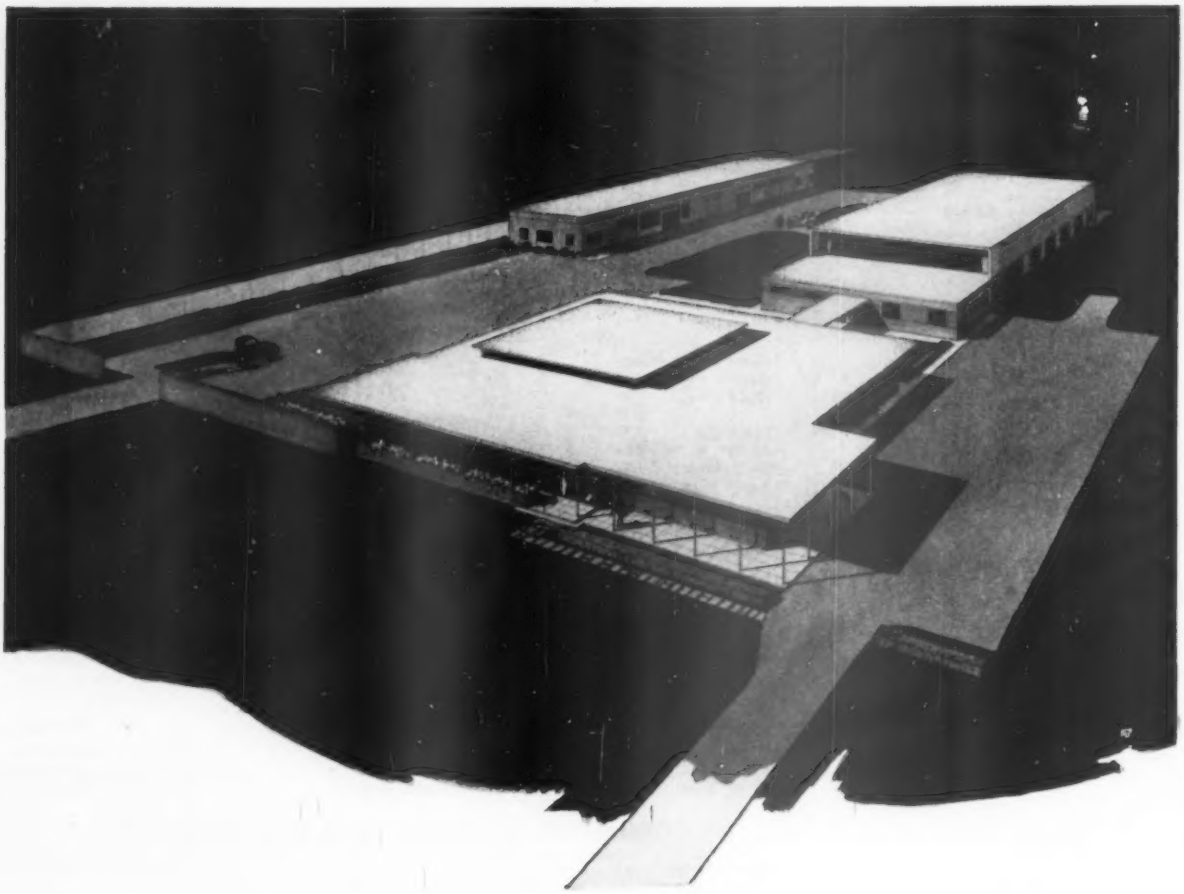

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FORMATION AND CASING TESTING — JOHNSTON

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CONTENTS

Editorial Features — Section 1

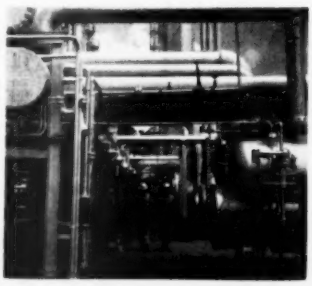
News Briefs 9
The Oil Wheel of Fortune, by H. J. Struth 11
Decline Curves in Reserve Estimation, reported by T. J. Nowak . 15
Technical Note: Determination of Graphite in Drilling Mud, by Frank O. Jones and J. L. Lemmus 11
1953 Fall Meeting 19

Petroleum Transactions

Capillary Desaturation in Unconsolidated Beads, by J. C. Calhoun and F. T. Bethel 197
The Estimation of Water Injection Profiles from Temperature Surveys, by T. J. Nowak 203
Measuring and Interpreting High-Temperature Shear Strengths of Drilling Fluids, by T. E. Watkins and M. D. Nelson . . . 213
Recent Laboratory Investigations of Water Flooding in California, by Norris Johnston and N. van Wingen 219

Institute Affairs — Section 2

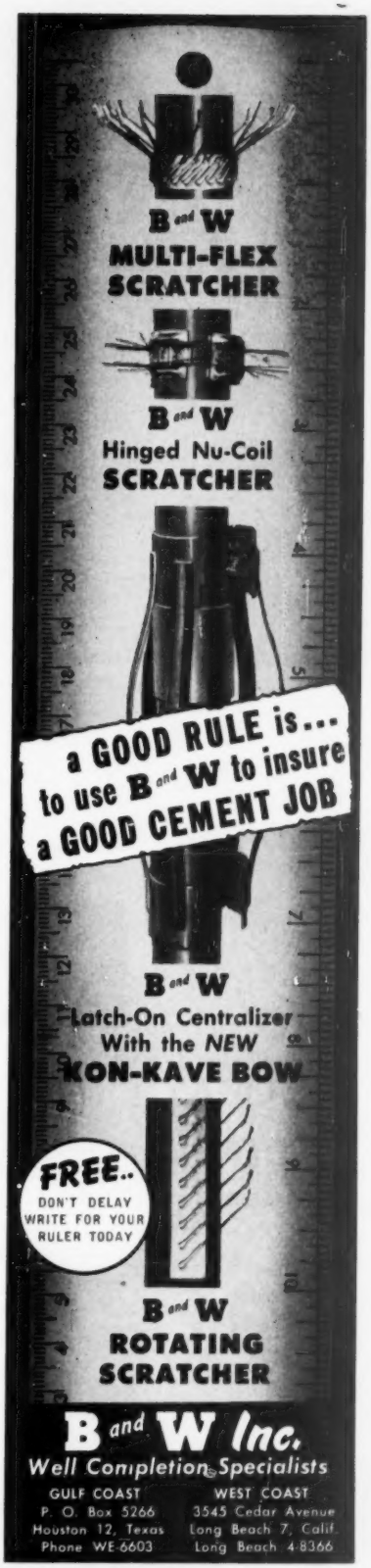
Personals 1
Petroleum Branch By-Laws Changes 4
Employment Notices 6
Advertisers' Index 8



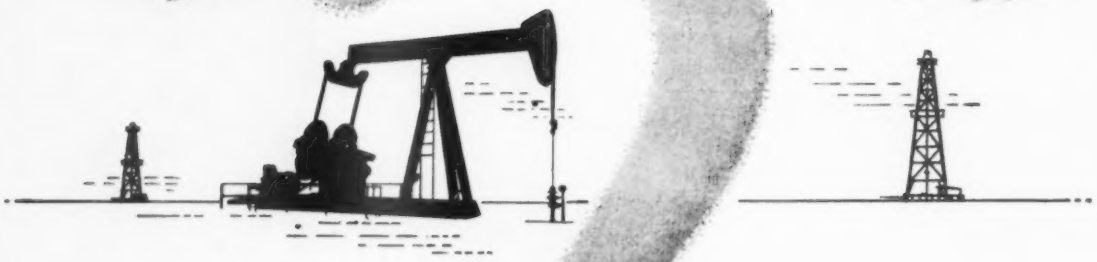
This Month's Cover

Gas plants of the petroleum industry are a maze of pipes, towers and tanks. On the cover this month, two employees walk in the distillation area of Humble Oil and Refining Co.' Opelousas Gas Plant. In the background are fractionator and absorber towers used in removing liquid products, natural gasoline, butanes, and propane from gas before it is transported to market.

—Photo by Humble Oil and Refining Co.



You guess . . . not!



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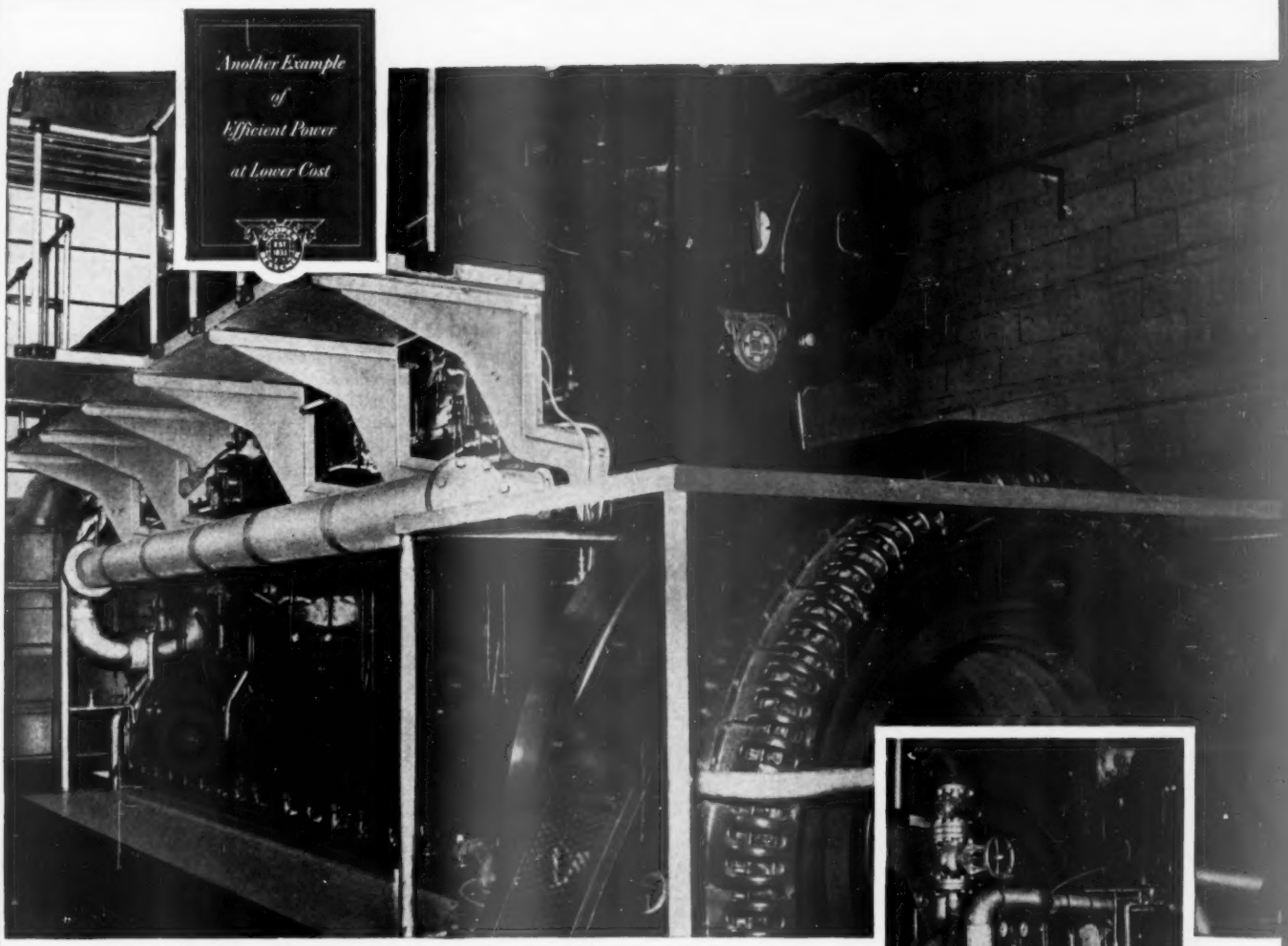

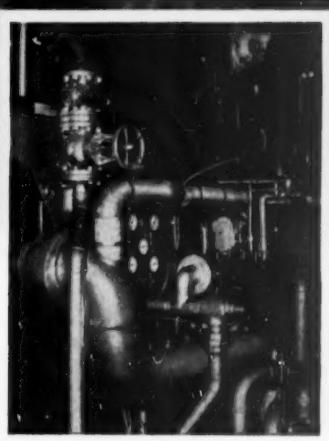

Latest of three **Cooper-Bessemer LS-8 diesels** in International Latex plant, this supercharged 1700 hp unit provides 40% thermal efficiency. End view at right shows piping setup for jacket water heat recovery contributing to 80% over-all thermal efficiency.

How they stretch dollars at International Latex

● Here's a diesel plant that is turning in amazing results—*80% over-all thermal efficiency!* The engine is a Cooper-Bessemer supercharged LS-8, installed in the International Latex plant at Playtex Park, Dover, Delaware.

To start with, this modern LS diesel exceeds 40% thermal efficiency — performance rarely equalled! On top of that, an ingenious jacket water heat recovery system captures for processing use another 40% of the total heat input.

In all there are three Cooper-Bessemer LS-8's in this International Latex plant—the supercharged unit shown above and two previously installed atmospheric LS-8's. Later on these original LS-8's can be easily converted to supercharged operation to boost their output and to match the remarkable efficiency of the new unit.

Whatever your power needs may be, check with Cooper-Bessemer. Find out how much you stand to save by the best to be had in efficiency and long, trouble-free engine life.

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Sandfrac is one of the methods developed by Dowell to fracture low-solubility formations. It is a versatile fracturing service. The special refined oils and propping agents used in Sandfrac can be tailored to fit the characteristics of almost any well.

The sands used in Sandfrac treatments are available in several sizes. To make this service even more effective, Mud Acid is frequently used before a Sandfrac treatment to lower the pressure in a tight formation.

Perhaps a Sandfrac treatment can make your marginal wells into good producers as it has for other operators.

Here are some examples of the results of Sandfrac treatments performed by Dowell:

Production from a well in a sand formation was increased from 6 to 288 BOPD; another well in a sand formation went from a show to 336 BOPD; and a well completed in a conglomerate formation went from a show to 672 BOPD.

Call the Dowell station nearest you. Ask for the facts on Sandfrac. An experienced engineer will be glad to call on you to discuss this or any of the many other oil field services made available to you by Dowell. However, if you prefer, you can write directly to Tulsa, Dept. H-15.

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News Briefs

The California Co. has just completed installation of heating cable sets around its pipe lines at Red Wash, Utah, to permit flow of oil at low temperatures. Oil from the field, high in paraffin content, is kept at approximately 100°F in storage tanks. From the tanks, the oil is sent some seven miles through field lines and injected into a trunk line to be mixed with other crudes. Each heating cable set is 437 ft long with 20 ft non-heating leads permanently molded to the cable. The sets were precoated with an asphalt base primer, a 3/16-in coating of asphalt enamel, a glass cloth wrap and a final asphalt application. At each control point, a thermostatic bulb control was laid in direct contact with the pipe line.

* * *

A total of 2,760 rigs were active in oil fields of the United States and Canada for the week ending Aug. 2, according to a report to the American Association of Oilwell Drilling Contractors by Hughes Tool Co. This figure compares with 2,772 reported the previous week, 2,825 last month, and 2,521 for the comparable week in 1952.

* * *

The third of a series of installations of The Atlantic Refining Co.'s catforming process has started successful operation. The unit, a 1,000 B/D catformer, is in the Husky Oil Co.'s refinery in Cody, Wyo. It will produce high octane gasoline by a new process developed in Atlantic's research laboratories. Atlantic is licensing the catforming process to a number of other refineries.

* * *

The National Science Foundation is supporting the compilation of registers of scientific and technical personnel by several professional scientific societies. Six additional societies, the Engineering Joint Council included, also plan to take part in the program to set up comprehensive decentralized registers to provide information on the nature and supply of scientists and engineers in the United States. Up-to-date information on about 100,000 scientists and engineers is expected to be on hand by June, 1954. By June, 1955, it is expected that registers will have been established in all major fields of science.

* * *

The industry in the Rocky Mountain region is having a big year. According to a report by *Petroleum Information*, it has just completed its most active six months in history. More than 265 rotary rigs were active as of July 1. The bulletin predicts a total of 3,390 completed wells for the region during the current year. The previous record was 2,357 wells completed during 1952. Completions so far this year number 1,377 of which 959 were development wells, and 418 were wildcats. Of the development completions, 508 were oil wells, 300 were gas wells and 151 were dry holes, for a success ratio of 84.2 per cent. Wildcat activity resulted in 43 oil discoveries, 16 gas discoveries and 359 dry holes for a success ratio of 14.1 per cent.

Anglo-Iranian Oil Co's second 32,000-ton tanker, "British Merchant," was launched at Newcastle-on-Tyne, England, last month. The ship, was the fifth tanker to be launched by the company this year. The others were four 16,000-tonners. Last December the company's first 32,000-tonner, "British Sailor," took the water and claimed the distinction of being the largest tanker launched in the world in 1952. Eleven more tankers are included in the company's present building program.

* * *

Meanwhile, $20 million in orders have been placed with American, British, and Australian equipment manufacturers for materials for Anglo-Iranian's new 60,000 B/D Kwinana Refinery near Fremantle, Western Australia. Orders placed in the United States total about $4 million.

* * *

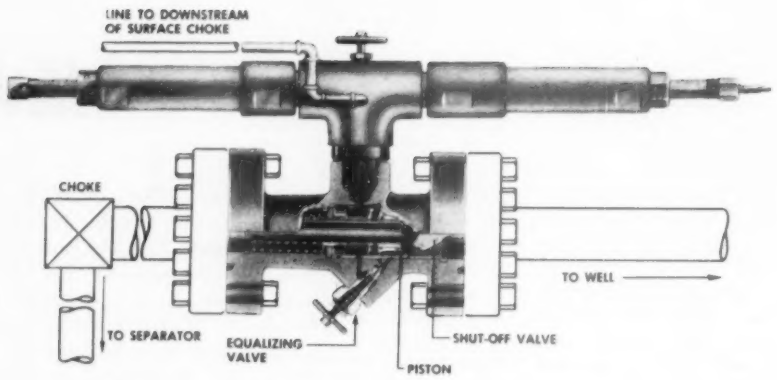
The Empire Trust Co. of New York City announces that Jack A. Crichton has been named president of Oil and Gas Property Management, Inc., and vice-president of Empire Trust. The company which Crichton now heads was formed in 1952 for the purpose of acquiring oil and gas properties. It is capitalized at $10,000,000 and has a current net oil production of approximately 2,500 B/D in East Texas, Anahuac, Old Ocean, Southwest Antioch and other fields. Crichton is a past vice-president and director of DeGolyer and MacNaughton and a past vice-president and director of San Juan Oil Co.

* * *

A center for holding and photoduplicating foreign scientific translations has been established by the National Science Foundation in the Science Division of the Library of Congress. Establishment of the center is part of a program to assist American scientists in keeping informed about current scientific progress in other countries. Monthly lists of translations newly received will be issued by the Library of Congress. Price list for translation copies: Photostats or enlarged microprints, 1 to 10 pages, $1.25; 11 to 15 pages, $1.75. Microfilms, 1 to 50 pages, $1.00. Inquiries should be addressed to Scientific Translations Center, Science Division, Library of Congress, Washington 25, D. C.

* * *

Sixty-three new specifications and tests were approved last month at the annual meeting of the American Society of Testing Materials held at Atlantic City, N. J. In addition, 185 existing tentatives and standards were acted upon. All new and revised standards will be published later in the year in the 1953 Supplement to the Book of ASTM Standards. These actions bring ASTM Standards to a total of 1,965.



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Bore through valve:	¾"-1"	1⅜"	1⅜"	2⅛"
Over-all length (± depending upon pilot settings):	38"	38"	38"	38"
Approximate weight, complete assembly*:	140#	160#	175#	198#

*—Data are for flange end models with Type M Pilot Fixture; screw end models, or valves without pilot fixture, also are available (see bulletins).

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OTIS — "EVERYTHING'S UNDER CONTROL"

The Oil Wheel of Fortune

By

H. J. Struth

Petroleum Consultant, Dallas

Nearly 5 Million Persons Depend on an Industry that Pours $17 Billion into the Nation's Economy each year. Here is what the Petroleum Industry means to the Man-In-The-Street.

People think of oil as "Big Business," and it is big, collectively, since it now ranks third in size of investment next to agriculture and public utilities. The gross volume of business shared by many thousands of companies and individuals that make up this nationwide business aggregated about $17 billion in 1952. This does not include revenues from natural gas utilities, compounding plants and retail sales of petroleum products through independently operated filling stations.

Few people have any conception of sums that run into billions of dollars. However, if we divide $17 billion by the number of minutes in a year, we obtain a more comprehensible figure of $32,344 per minute. Even this is more money per minute than many make in a year, or even in several years.

But, a fact that is far more significant to the man on the street, whether he is a merchant, a mechanic, a clerk, a farmer, a policeman, or a government worker, is the money that is spent by the oil industry, and just how it affects his immediate welfare. The fact is that for every dollar the oil industry takes in from the sale of its products, it spends 92.2 cents for payrolls, leases and royalties, taxes, dividends, and various capital charges against the replacement of oil and equipment. The average oil income dollar provides only 7.8 cents, on the average, as surplus for reinvestment in the business.

Economic Influence

A consolidated financial statement of the United States oil industry for 1952 reveals some highly interesting and conclusive facts that should be made available to the general public. After all, an industry which spends money in such huge proportions is bound to exert a tremendous influence upon the economic welfare of practically every community and family in the nation. Practically everything that is made and used today comes in contact, directly or indirectly, with the oil dollar. Name anything from a pack of cigarettes to an automobile, or from a bunch of carrots to a sirloin steak, and it will be found that some of the money paid to the vendors originated in the oil business — from some business dependent upon or allied with oil.

If the payrolls of those who are employed in the retail distribution of petroleum products are included, and the taxes that are collected on the sales of products to consumers, the amount of cash generated by the oil industry, which reaches into every state and practically every phase of industrial and commercial enterprise, attains a staggering total of $18,301 million. This amounts to $34,820 every minute of every day and night. This money finds its way into many thousands of industries which make and sell their goods and services to the oil industry.

It provides employment to more than four times as many men and women as the number that are directly employed by the oil industry.

It reaches into every channel of retail trade and professional services through the buying power of the oil industry's wages and salaries.

It provides an "extra crop" to farmers and landowners, through the payments of lease rentals, lease bonuses and royalties.

It pays the salaries of hundreds of thousands of men and women who work for the federal and state governments.

It provides money for public improvements, civil services and national defense.

It creates added wealth and buying power for millions of men and women who own the oil industry through investments in oil securities.

It does not take any great stretch of the imagination to realize that the distribution of this tremendous wealth has a pronounced effect upon the economic welfare of practically everyone living in this nation. One-third of this vast sum was spent last year for goods and services alone. The tax collectors' take exceeded the combined payrolls of all the workers in the oil industry. The tax collectors got 27.2%, while the oil industry's workers received 26.3% in wages and salaries. Landowners and stockholders received 13.5%.

Table 1

The United States Oil Industry — Year 1952

	Total Amount (Mill. $)	Cents per Dollar	Amount per Minute
Gross income from products (2,824,515,000 bbl)	$17,000	100.0	$32,344
Salaries and wages (a)	3,458	20.3	6,579
Leases and Royalties	1,386	8.1	2,637
Goods and Services	6,056	35.6	11,522
Capital Charges	1,700	10.0	3,234
Direct Taxes (b)	2,000	11.8	3,805
Dividends (cash and stock)	1,080	6.4	2,055
Total Expenditures	$15,680	92.2	$29,832
Surplus for Reinvestment	1,320	7.8	2,512
(a) All Payrolls (Includes retail mktg.)	4,808	28.3	9,148
(b) All Taxes (Includes sales taxes)	4,971	29.2	9,458

Table 2

Cash Generated by the Oil Industry — Year 1952

	Total Amount (Mill. $)	Cents per Dollar	Amount per Minute
Goods and services	$ 6,056	33.0	$11,522
Tax Collectors	4,971	27.2	9,458
Employees	4,808	26.3	9,148
Landowners	1,386	7.6	2,637
Stockholders	1,080	5.9	2,055
Total	$18,301	100.0	$34,820

The oil industry provides direct employment for 1,426,500 men and women. At 3⅓ persons per family, this embraces 4,707,450 men, women and children who are directly dependent upon this one industry. In a recent survey prepared by the writer, it was found that for every job in the oil industry there are 4.2 jobs in other industries that exist primarily because of oil. These include petroleum equipment, motor vehicles, aircraft, commercial airlines, oil burner manufacturers; power driven machinery, motor boats, truck and bus transportation, and numerous other industries that are related to oil. This means that 5,991,300 men and women are employed in industries that are directly related to oil, and which exist because of oil. Together with the oil industry's employees they comprise an army of 7,417,800 workers. With their families they embrace 24,508,740 men, women and children who get their living directly and indirectly because of oil.

Add to these the hundreds of thousands of men and women who own land and receive lease rentals and oil royalties, as well as those who receive dividends from oil securities, and it becomes evident that a substantially large segment of the national population has a stake in the welfare of the oil industry. These figures become even more astounding when those employed in allied branches of the oil industry, such as natural gas utilities, carbon black manufacturers and compounding plants, are included.

Expanding Demand

The gross income of the oil industry in 1952 was equivalent to 14.3 cents per gal of all the oil sold in domestic and foreign trade. However, after providing the tremendous expenditures incident to the operation of all of the oil industry's vast facilities, the amount of money retained as profit and reinvestment capital was equivalent to only 1.1 cents per gal. The thirst for oil by consumers of petroleum products produced in the United States last year was quenched with a volume of 2,824,515,000 bbl. This means that during every minute of the year, night and day, the demand for oil amounted to nearly 5,375 bbl, or nearly 226,000 gal per minute. Within the United States, the per capita consumption of oil amounts to 714 gal a year. With the national population growing at the rate of five persons per minute, the demand for oil is expanding at the rate of 3,667 gal per minute.

Every 1 per cent increase in demand for oil this year will mean an increase of 28,245,000 bbl. This year, it is likely that the demand for United States oil will show a further increase of 5 per cent. This means an increase in volume of 141,225,000 bbl, or a daily average of nearly 387,000 bbl. Any appraisal of the future outlook for the American oil industry cannot fail to bring the conviction that the trend of demand will continue to rise to new high levels each year in the foreseeable future.

The significant fact is that as the demand for oil increases, there will also be relative increases in expenditures, which will continue to have a favorable effect upon the economy of the nation and its people. The cash generated by the oil industry in 1952 was equivalent to about $6.40 for every bbl of oil consumed. This indicates the possibility that the wealth distributed through oil this year may be greater by more than 900 million.

The extent to which oil is tied in with the national economy is evident since practically everyone living in the United States today uses petroleum in some form, either as fuel, lubrication, chemicals, plastics, cosmetics, and even clothing. During the past year the nation's population increased 2.7 million. Birth statistics show that seven new babies are born every minute. Our national income increased last year by $12.8 billion, or at the rate of $24,350 per minute. There are more than 53 million motor vehicles in the United States, and new cars and trucks are going onto the nation's highways at the rate of four every minute.

There are now in use on the nation's railroads 21,000 diesel locomotives, and a new diesel engine is put into operation every two hours and 42 minutes. Our farmers operate 4½ million tractors, and a new tractor gets under way on some farm every two minutes and 36 seconds. About 6½ million homes are now heated with oil burners and a new oil burner is installed in another home every 78 seconds. Our domestic oil supply is being produced at the rate of 5,450 bbl a minute, and we are importing foreign oil at the rate of 700 bbl per minute. It is not difficult to realize by the rates of growth in oil consuming units that the demand for oil is on a continually ascending plane.

Oil is being produced now in 27 states, and with natural gas embraces 29 states. Oil refining operations are carried on in 36 states, and natural gasoline extraction plants are operated in 19 states. The vast net-work of oil pipe lines crisscrosses 40 states, and natural gas pipe lines extend into 38 states and the District of Columbia. Retail filling stations are found in every state, in the cities and towns as well as in the remotest sections, where highways become mere trails. All of this, coupled with the tremendous expansion in the use of liquefied petroleum gas for rural cooking and heating, spells money in the form of payrolls, goods and services, and taxes.

Payrolls represent only 26.3 per cent of the cash generated by the oil industry, but this amount ultimately winds up in the markets of the community, the local bank, and in the pockets of the landlord. A substantial share of the paycheck is collected in the form of taxes by state, local and federal governments. Some idea of the tremendous sums put into circulation through the paychecks of oil workers may be seen in Table 3.

Industry Dependents

Many people living in states that are far removed from oil fields seldom realize that oil plays a definite role in their economic status. Ask the average man in Minnesota, Wisconsin, and New Jersey if there is any oil money in his state and he will reply emphatically "No!" But, if he investigates the matter he will find that there are several oil refineries in his state; that many miles of pipe lines cross his state and that several thousand filling stations dot the highways. Some of the large factories that he may not associate with oil are perhaps depending upon the oil industry for a major share of their business. All of this means employment and money spent in the community by the families of the workers.

The payrolls of the oil industry are divided as follows:

Drilling and Production	$1,771,581,000
Refining and Processing	1,336,000,000
Pipe Lines (oil only)	350,000,000
Marketing	1,350,000,000
Total	$4,807,581,000

Table 3

Oil Industry Payrolls by States

State	Oil Industry Payroll
Texas	$905,480,000
California	433,340,000
Louisiana	227,490,000
Oklahoma	163,693,000
Illinois	147,978,000
Pennsylvania	127,306,000
Kansas	111,248,000
New Jersey	93,798,000
New York	72,954,000
Wyoming	53,048,000
New Mexico	39,301,000
Arkansas	33,292,000
Minnesota	24,475,000
Wisconsin	22,086,000
Florida	20,405,000
Connecticut	10,904,000
North Dakota	6,126,000
Rhode Island	5,408,000
Nevada	1,822,000
Total 19 states	$2,500,154,000
All other	2,307,846,000
Grand Total	$4,808,000,000

The price of crude oil today is $2.56 per bbl, but analysis of income and expenditures in the drilling and producing branch of the oil industry indicates that the surplus after all expenses, excluding dividends and income taxes, is only 18 cents per bbl. The gross value of crude oil in the United States last year was $5,867,520,000, but the cost of exploration, development, production, and royalties paid to landowners aggregated $5,440,565,000, which left only 7.3 per cent for the producer. The facts prove that oil production today is not as profitable as many may believe. In fact, for every net bbl of oil produced last year the industry spent $1.01 for exploration; 58 cents for development, and about 75 cents for production. The net return of the average oil well in the United States last year amounted to only $875.

The cost of finding oil in the United States today is about 98 cents per net bbl or working interest. This is 6½ times the average cost of finding a bbl of oil back in 1935-39. Last year the oil industry spent $1,987 million for exploration, or at the rate of $102,700 per exploratory well. The cost of exploration in 1952 comprised nearly 40 per cent of the net working interest value of all the crude oil produced in the United States. This is a significant fact in the light of repeated attempts of the Government to discredit the oil industry's long-recognied depletion allowance of 27½ per cent.

Despite constantly rising costs, the oil industry drilled 187,000,000 ft of holes last year, which was equivalent to 35,409 miles. In time element, the industry drilled one mile of hole every 15 minutes. Efforts to find and develop oil production last year involved the drilling of 19,350 exploratory wells, of which only 1,640 were successful. 92 per cent of such efforts were failures, and involved a combined cost of nearly one billion dollars. During 1952, the oil industry drilled a total of 17,710 dry holes, or at the rate of one dry hole every 30 minutes. By comparison, a wildcat producer was completed every five hours, and one wildcat gas well came in every 33 hours. Productive wells drilled in proven fields were completed at the rate of one every 21 minutes. All drilling last year involved a total of 45,920 wells, or at the rate of one well every 11 minutes.

For every barrel of new oil reserves discovered in new fields last year, the industry found 3.1 bbl through extensions to previously discovered fields. Since 1859, the oil industry has discovered 78.5 billion bbl of oil and has produced and consumed 45.5 billion bbl, or about 58 per cent of all the oil found to date. Those who say our nation is running out of oil may well ponder the fact that for every 100 bbl produced thus far, 172 bbl of proved reserves have been found. In the last five years, discoveries have averaged 3,923 million bbl a year, against an average annual production rate of 2,257 million bbl.

Oil Replacement Costs

Thus, the industry is finding 174 bbl for every 100 bbl of oil produced and consumed. During this five-year period, oil reserves discoveries have been increasing at the rate of 3,170 bbl per minute. At the close of 1952, the nation's productive oil wells aggregated 484,600, which was an increase over the preceding year of 9,610 wells. This means that a new producing oil well was placed in operation every 55 minutes, with average available underground reserves of 68,275 bbl. These facts refute unwarranted expressions of alarm over the nation's future oil supply.

An alarming fact in the nation's petroleum reserves situation, and one which the financial statements of the oil companies do not reveal, is that oil replacement costs are consuming a constantly greater share of the oil income dollar. Increasingly greater sums derived from the integrated operations of the petroleum industry are being plowed back into the building of future reserves. These must ultimately be produced at a far greater cost than the oil from which today's profits are being made. Most of the oil being produced today comes from reserves that were found 10 to 15 years ago, when finding costs were but a fraction of what they are today. In other words, the oil industry is taking oil from underground reserves which previously cost 15 to 20 cents per bbl, and is replacing it with new reserves that are initially costing 98 cents per bbl.

With the demand for oil growing each year by leaps and bounds, it is obvious that there can be no let-up in the search for new sources of oil supply. By the same token, all physical facilities of the national oil industry must continue to be expanded in relationship with expanding demand here and abroad. Any excesses in the current oil supply, particularly with respect to oil in storage, may be viewed as being decidedly temporary. The pace established by the growing demand, through the constantly increasing incidences of oil consuming units, will make today's excesses appear decidedly inadequate for tomorrow.

Out of all these facts and computations, one fact stands out — high above them all — and that is the fact that a vigorous and prosperous oil industry spells more goods and services; more salaries and wages; more lease rentals and bonuses; more oil royalties; more taxes for the communities, the states, and the federal government; and more income for those who own a share in the oil industry. All of these items are highly important to the economy and welfare of millions of men, women and children who live in every section of this nation.

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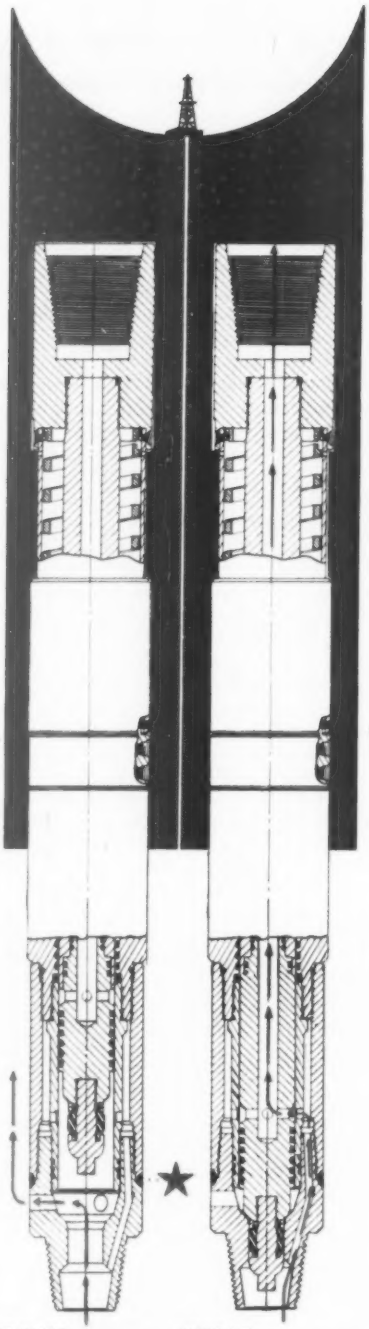
The two-way valve permits weight to be set down for a time interval, allowing packer to expand before tool opens, and prevents premature opening of tool if bridge is hit. Time interval is determined by weight set down, after which tester valve opens rapidly, giving definite movement on weight indicator needle. When weight is removed, mandrel returns to extended position, closing tester valve and opening by-pass.



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RESERVE ESTIMATION—I

Decline Curves in Reserve Estimation

Reported by
T. J. Nowak
Union Oil Company of California

R. W. Clark, petroleum engineer for the Richfield Oil Corporation, presented the first talk of a series of ten being given under the auspices of the Petroleum Technology Forum, of the AIME Pacific Petroleum Chapter and dealing with reserve estimation and property evaluation. In this series, the AIME will present four talks on reserve estimation, four talks on property evaluation, and two talks on general subjects pertinent to this series. Each talk will be given by a man who has had considerable experience bearing on the respective subject.

R. W. Clark, of Richfield Oil Corp., discussed the use of the production decline-curve method in recoverable reserve estimation. The method is based on the premise that the trend of the past production history of a well, property, pool, or field is the key to forecasting its future behavior. It is especially applicable to wells produced freely and without curtailment. Such production histories are characteristic of many California oil well.

Clark pointed out that the decline trend of the production rate can be analyzed quantitatively either statistically, mathematically, or graphically. All three methods were described by J. J. Arps in "Analysis of Decline Curves," the AIME *Transactions*, 1944. Clark limited his discussion to the most commonly used technique; namely, the production decline-curve method. The technique is merely that of plotting the production rate *vs* time in such a graphical form that the resulting production decline curve can be extended with the use of a straight edge to the time point when the production by the method used no longer provides a profit. This point is called the economic limit. The integrated area under the curve between the units of current time to the time at the economic limit is equal to the estimated recoverable reserves. When the production rate *vs* time data are plotted on cartesian coordinate paper, the resulting curve is difficult to extrapolate to the economic limit because the degree of curvature cannot be continued by eye. For this reason, depending on the production decline rate that is apparent from the past performance, it is customary to project the production rate on one of two general bases that will provide a straight line extrapolation: (1) Constant percentage decline, or exponential decline, in which the production rate is plotted *vs* time on semilogarithmic coordinate paper, and (2) Variable percentage decline rate, or hyperbolic deline, in which the production rate is plotted *vs* time on log-log coordinate paper. In this case, a certain amount of adjustment to the time scale by cut and try method may be necessary before a straight line projection is possible.

For the case where the production decline curve is not a straight line in either of the above classes or where uncertainty exists in the applicability of either of the classes to the analysis of the curve, Clark proposed a third technique of graphical analysis. It involves the application of both the constant percentage decline and the variable percentage decline curve, plotted on semilog paper. Further details of Clark's talk are presented below:

Constant Percentage Decline

The constant percentage decline, also called exponential or semi-log decline, is characterized by the fact that the production rate at any time is a constant fraction of its rate at a preceding date. This fraction can be expressed as a constant percentage decline. Relationship between two variables that shows a constant decline can be graphically represented by a straight line on semilog paper. For example, when the average monthly production rate is plotted on the vertical logarithmic scale against the corresponding time on the horziontal linear scale and a straight line trend is indicated, the constant percentage decline method is applicable for estimating the future production of the wells, providing the wells continue to be produced by the present operating methods.

During the course of the discussion, Clark presented a workable method of estimating reserves by the use of charts and formulae which eliminate much of the calculations. These charts are published in the aforementioned publication.

Variable Percentage Decline Rate

When the production rate *vs* time plot on semilog paper shows curvature, it can usually be presented as a straight line on log-log paper after appropriate shifting along the time scale and the straight line may be extended to estimate the recoverable reserves and the future life. The straight line relationship on the log-log paper classifies the production decline curve as of the hyperbolic, the "log-log", or the variable percentage decline type. Details of the method of shifting a production decline curve plotted on the log-log paper into position until it assumes a shape that is either straight or nearly so is described in the U. S. Bureau of Mines *Bull.*, (1924), 288, by W. W. Cutler. That position where the curve becomes a straight line is indicative of the relative rate of decline in production throughout the curve. Remaining economic life is obtained by extending the straight line to the economic limit and taking the difference between the time at the economic limit and the current production time. The estimate of recoverable reserves is obtained by multiplying the summation of the production rates at midyears throughout the remaining economic life by 365 days.

Adaptation of Variable Decline for Supplemented Use with Constant Decline

Most production decline curves can be classified into either constant or variable decline types. As previously pointed out, the type can be recognized by graphical means. Some-

(Continued on Page 7, Section 2)

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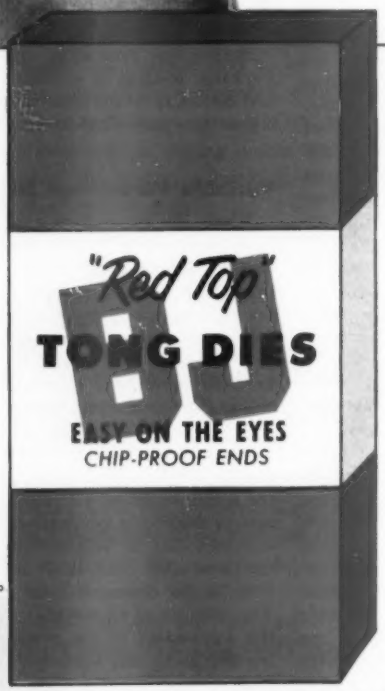

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Technical Note 185

DETERMINATION OF GRAPHITE IN DRILLING MUD

FRANK O. JONES, JR., AND J. L. LEMMUS, STANOLIND OIL CO., TULSA, OKLA.

ABSTRACT

A field procedure for determining graphite in drilling mud is presented which is sensitive to 0.25 lbs/bbl and accurate to 20 per cent. The method, utlizing oil flotation principles, is suitable for use in all oil-free water base muds except those containing lignosulfonates, lignites, or surface active agents.

INTRODUCTION

Graphite was proposed as a drilling lubricant as early as 1940,[1, 2] but has not been used extensively until recently.[3] Graphite has been substituted for oil in certain instances to avoid oil contamination of core samples since it has been found that graphite does not interfere with routine core analysis.

A major difficulty in using graphite is the lack of a satisfactory field test for determining the concentration of graphite in mud.

DISCUSSION OF METHOD

Several possible methods of analysis were investigated, including chemical separation, density fractionation, radioactive tracers, and oil flotation.[4, 5]

The investigation indicated that a satisfactory method for field use could be devised using an oil flotation method. It was found that toluene shaken with a higly diluted mud sample would recover sufficient graphite to be apparent in the oil phase. Refinement and standardization of technique made it possible to detect as little as 0.25 lb/bbl graphite and to estimate graphite content to within 20 per cent by using a visual comparison method.

The test is limited to oil-free water base muds. Quebracho, phosphates, or barytes in the mud do not interfere with the test but surface active agents, lignosulfonates[6] and lignites evidently render the graphite water-wet so that none may be recovered by oil-flotation.

PROCEDURE

Instructions for determining graphite in mud:

1. Collect representative one gallon sample from mud stream. Transfer immediately 350 ml portions of this sample into four mixing cans labeled A, B, C, and D. Measure out graphite (same as is used to treat mud) for addition to cans as indicated below, using either a specially designed scoop or a balance.

Can:	A	B	C	D
Grams Graphite to Add:	none	2	4	6

Stir samples B, C, and D for 15 minutes with propeller type mixer.

2. Clean and rinse well with water four 250 ml volumetric flasks labeled I, II, III, and IV. Using a 5 ml hypodermic syringe, transfer the indicated volume of samples from cans A, B, C, and D into designated flasks as follows:

From Can:	A	B	C	D
To Flask:	I	II	III	IV
Add This Volume of Mud:	4 ml	2 ml	2 ml	2 ml

3. Measure 100 ml fresh or distilled water to each flask and swirl gently to disperse mud. Add exactly 5 ml toluene to each flask. Stopper and shake each flask vigorously 75 times (this definite amount of shaking which requires about 20 seconds is important) and add water to each flask immediately after shaking until liquid level is about one inch from top of neck. All four flasks should be shaken and filled to level within a five-minute period. Flasks should then be allowed to remain undisturbed for 45 minutes.

4. Examine oil layers in the necks of the flasks. A layer will grade from clear toluene at top to a darkened emulsion at the bottom, the volume and darkness of the emulsion depending upon the amount of graphite in the flask. Compare flask I to flasks II, III, and IV. Select flask containing emulsion which most nearly matches emulsion in flask I. See table below for graphite concentration in original mud.

If flask matching Flask I is:	Flask II	Flask III	Flask IV
Graphite concentrations in mud is:	2 lb/bbl	4 lb/bbl	6 lb/bbl

The results obtained at this point are suitable for most uses; however, if greater precision is required, the remaining two steps may be followed.

5. Clean mixing cans and flasks. Restir gallon sample taken in step 1. Repeat step 1 except instead of adding 2, 4, and 6 gm. graphite to cans B, C, and D, add graphite according to following table, which lists three alternatives depending upon the value found in step 4.

If result, step 4 was	Add to can: B	C	D
2 lb/bbl	1 gm	2 gm	3 gm
4 lb/bbl	3 gm	4 gm	5 gm
6 lb/bbl	5 gm	6 gm	7 gm

6. Proceed exactly as in steps 2, 3, and 4, except instead of using the table in step 4, use the following table to find graphite concentration of mud. Select value in left column corresponding to result from step 4 and read across to the right to number beneath flask which matches flask I.

Find graphite concentration below flask matching flask I:

If result, step 4, was	Flask II	Flask III	Flask IV
2 lb/bbl	1 lb/bbl	2 lb/bbl	3 lb/bbl
4 lb/bbl	3 lb/bbl	4 lb/bbl	5 lb/bbl
6 lb/bbl	5 lb/bbl	6 lb/bbl	7 lb/bbl

REMARKS

1. If the emulsion in flask I is very much darker than "Gunmetal Gray," reduce the volumes of mud extracted (step 2); *i.e.* instead of 4 ml for flask I and 2 ml for flasks II, III, and IV, use 3 ml and 1.5 ml or 2 ml and 1 ml. If the emulsion is much too light, increase the mud volume proportionately.

2. If there is no graphite coloration in any of the emulsions of the four flasks, first check to be sure there is no soap or detergent in the flasks or mud; second, try increasing the volumes of mud extracted. If no coloration is detected, conclude that there is a wetting or dispersing agent in the mud stream which prevents the graphite from being wet by oil; in such case the test is ineffective.

CONCLUSIONS

A field method for determining graphite in drilling mud has been devised which is suitable for use in all types of oil-free water base muds except those containing lignosulfonates, lignites, or surface active agents.

ACKNOWLEDGMENT

The authors wish to express appreciation to Stanolind Oil and Gas Com-

(Continued on Page 3, Sec. 2)

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Dallas Section Plans Outstanding Fall Meeting

By Joe B. Alford
Secretary, Petroleum Branch, AIME

The growth of the Petroleum Branch since War II was evidenced last year at the Branch Fall Meeting in Houston, with the attendance of 1,800 members and guests when 1,400 were expected. Although some members feel that our meetings have become almost too large, there seems to be no stopping of the trend in this direction. The forthcoming Petroleum Branch Fall Meeting in Dallas, October 18-21, will probably be attended by 1,700 members and guests, and will have more technical papers and entertainment functions than any of our previous Meetings. The Dallas Local Section, under the chairmanship of Eugene R. Brownscombe of the Atlantic Refining Co., is "busting a hame string" in planning a meeting that you will enjoy. So, if you are coming to Dallas in Ocober, you can anticipate the meeting with the same pleasure as an *aficionado* going to see his favorite matador.

Entertainment Functions

The ladies, under the direction of Mrs. Don J. Shaw, are staging the first function with a milk punch breakfast at 9:30 a.m., Monday, October 19, in the clubrooms of the Engineer's Club of Dallas. No research has yet been reported on how milk punch muddles the head at that time of day for listening to technical papers, so you boys are advised to steer clear. You can open the fun with the Welcoming Luncheon on Monday, to be held in the Roof Garden of the Adolphus Hotel. H. N. Mallon, president of Dresser Industries, will address the luncheon. Because of the limited space available for the luncheon this year, it is not planned for the ladies to attend.

One of the memorable occasions of the 1948 Fall Meeting in Dallas was a cocktail and dinner party given by DeGolyer & MacNaughton in the home of E. DeGolyer. A similar party will be given by DeGolyer & MacNaughton this year on Monday evening, October 19, at the Brook Hollow Country Club in Dallas.

The ladies take the pitch again on Tuesday noon with a Ladies' Luncheon and Style Show in the Mural Room of the Baker Hotel. The early part of Tuesday evening brings a cocktail party in the Dallas Petroleum Club with Core Laboratories and San Juan Oil Co. as joint hosts. From 7:00 p.m. until midnight, members and their ladies will enjoy the primary social function of the meeting—the annual Petroleum Branch Banquet and Dance. This will be held in the Crystal ballroom of the Baker Hotel, and since the Dallas Petroleum Club is also in that hotel, those attending the Banquet will be able to move to it easily from the cocktail party in the earlier part of the evening. A name band will play for the dance.

Since the meeting will be held during the State Fair of Texas, a plan has been developed for the ladies to visit the Fair on Wednesday, October 21. Transportation will be available from the downtown hotels for this occasion. The entertainment functions of the meeting will then be concluded by a cocktail party and barbecue supper at the Security Engineering Co. plant in Dallas, with Dresser Industries as hosts.

The Technical Program

The Branch Technology Committee, under the chairmanship of William H. Justice, is due a vote of thanks from the membership for developing what promises to be an outstanding technical program. The committee determined at an early date how many papers, in each of several technological fields, should be selected for the program, and then solicited papers to fit the program. As a result, the program is well balanced, and contains more of the "operational" type paper than in recent years.

The prospective program was published in the July JOURNAL OF PETROLEUM TECHNOLOGY, and will be published again, with the abstracts of all papers, in the September issue. At present it contains 45 papers, and to accommodate them it is likely that three concurrent technical sessions will be held on Tuesday morning and afternoon, October 20. This will be the first time that this has been necessary. At time limit will be placed on the oral presentation of papers and it is likely that a limit will also be placed on discussions.

General

Rooms are still available at the Adolphus Hotel in Dallas. If you have not yet made your reservations do so soon by writing direct to the hotel.

Everything shapes up to indicate that the Dallas Local Section will stage a Dallas meeting that you will remember. Better come.

Pacific Petroleum Chapter Fall Meeting

On Oct. 1 and 2 the Pacific Petroleum Chapter will be host to their 1953 Fall Meeting in the Ambassador Hotel in Los Angeles. In addition to two days of technical programs, there will be exhibits, social functions, and other outside activities.

Social activities will begin Thursday, Oct. 1, with a buffet luncheon, to be held on the south lawn of the Ambassador Hotel. Claude R. Hocott, Petroleum Branch Chairman, will be introduced to those attending. A theater party is planned for Thursday evening.

On Friday the Southern California Local Section of the Institute will sponsor a luncheon in the Coconut Grove of the Ambassador Hotel. Robert Evans Vivian, who has recently returned from a trip for the U. S. Government to Malaya, Formosa, Thailand, and parts of China, inspecting facilities for chemical processing, will speak to the group on, "An Engineer Looks at the Orient."

The Annual Dinner Dance will be held Friday in the Embassy Room of the Ambassador, featuring Glenn W. Ledingham, Manager of Exploration for Western Gulf Oil Co., as speaker.

General Chairman for the meeting is Morton T. Higgs, vice president of Lane Wells. Chairman of the host Section is F. Lowry Wadsworth, General Petroleum Corp.

The technical program, under the direction of C. C. Liedholm, Signal Oil & Gas Co., will contain seven technical papers and a forum on directional drilling.

This will be the first year that the meeting has been conducted entirely under the sponsorship of the Pacific Petroleum Chapter. In previous years it has been considered a Petroleum Branch meeting, but this year it will be named and conducted as the Pacific Petroleum Chapter Fall Meeting. This is in order to enable the Petroleum Branch to conduct only one major Fall Meeting each year. This meeting will be held in Los Angeles in 1956, and will be held in conjunction with the Pacific Petroleum Chapter in that year.

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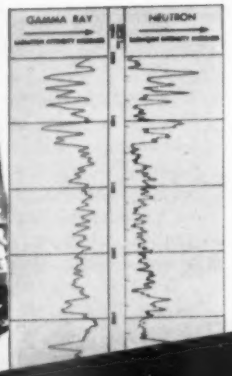

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Personals

DR. RICHARD V. HUGHES has been appointed technical assistant to the vice president of Gulf Oil Corp., Houston Division, to succeed Paul Weaver, who has recently retired. The appointment was effective June, 1953. Dr. Hughes came to Gulf from Stanford University, where he served as visiting lecturer, professor, and head of the department of petroleum engineering. He received his BS at the University of Nebraska and was awarded his doctorate in geology from Johns Hopkins University in 1933. The author of many technical publications, he has specialized in geology, secondary recovery of oil, and clay research as applied to well completions and production operations.

Hughes

+

E. N. DURHAM, with Shell Oil Co. in Wichita Falls, Tex., will be on special assignment in The Hague, Netherlands, for seven months and will return to New York for six months.

+

LEROY VANCE HESTER, formerly reservoir engineer for Stanolind Oil and Gas Co. in Okmulgee, Okla., has been transferred to Gorham, Kansas, as field engineer for Stanolind. He will reside in Hays, Kansas.

+

WILLIAM H. JUSTICE has succeeded Paul R. Turnbull as drilling and production manager for La Gloria Corp., Corpus Christi, Tex., effective July 1. A native Oklahoman, Justice graduated from the University of Oklahoma in 1935 with a BS in Chemical Engineering. He was employed by the Tide Water Associated Oil Co. in 1935 and worked with them in Oklahoma and Texas until 1948, when he joined La Gloria as technical advisor.

Justice served as vice chairman of the Technology Committee in 1952 and is the committee's present chairman. He has prepared numerous papers for the Institute on gas and cycling problems.

SCHOEL SCHULMAN, formerly field engineer and crew chief for the Geological Logging Co. in Houston, Tex., is now associated with the El Paso Natural Gas Co. in Farmington, N. M.

+

BARRY LOUIS EVANS has been promoted to assistant petroleum engineer for the Honolulu Oil Corp. in San Francisco.

+

CHARLES A. EINARSEN has become area manager for Cherokee Labs, Inc., in Mindland, Tex. He was recently a research engineer for Stanolind Oil and Gas Co. in Tulsa, Okla.

+

PAUL W. LAMBRIGHT, vice-president and general manager for Peruvian operations of the International Petroleum Co., Ltd., has been transferred to the company's executive offices in Coral Gables, Fla.

+

WESLEY R. LUND who has been with Bataafsche Pet. Matschappij in The Hague, is now located in Shell Oil Co.'s New Orleans, La., Office.

+

CHARLES B. AMMANN, junior petroleum engineer for Sinclair Oil and Gas Co., has been transferred from Drumright, Okla., to the company's division office at Oklahoma City.

+

HERMAN E. SCHALLER has been named western division sales manager, radiation logging department, by McCullough Tool Co. Schaller, formerly sales engineer for McCullough, received his MS degree in petroleum engineering.

+

WILLIAM HURST has established his office as a petroleum reservoir engineer in the Melrose Building in Houston, Tex. Hurst will work on valuation of reserves, reservoir mechanics, and serve as a technical witness before regulatory bodies. He was formerly affiliated with Petroleum Consultants in Houston.

+

KEITH D. JUNG has joined General Petroleum Corp. following his graduation from the Colorado School of Mines.

JAMES G. HEID is presently located with Monterey Oil Co. of Los Angeles as petroleum engineer. He was formerly with Continental Oil Co.

+

DR. MICHAEL J. RZASA has been named director of Cities Service Research and Development Company's newly organized production research laboratory in Tulsa, Okla. He was formerly research group supervisor with Stanolind Oil and Gas Co. Dr. Rzasa received his BE from Yale University and his MS and Ph.D. from Michigan University.

RZASA

MURDOCH

J. B. (BENNY) MURDOCH has announced his resignation as technical advisor to the president of the Eastman Oil Well Survey Co. in Denver, Colo., to return to California where he will engage his own business. He became associated with the oil well service field with Eastman as an office engineer in 1933, later became chief engineer, and two years ago was promoted to technical advisor.

+

HARRY NEWELL APPLETON, AIME Assistant Secretary and Convention Manager, on completion of 25 years' of service on the AIME staff, was presented with an engraved desk set by President Andrew Fletcher at the AIME Board of Directors meeting on July 8. The set was appropriately engraved, "in appreciation of 25 years' of loyalty to AIME." In return, Mr. Appleton expressed his appreciation of the gift and of the pleasure he had derived from his association with the Institute during the last quarter-century.

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Graphite in Drilling Mud

(Continued from Page 17, Sec. 1)

pany for permission to publish this technical note.

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Proposed Changes in Petroleum Branch By-laws

TO PETROLEUM BRANCH MEMBERS:

Shown below are some amendments to the Petroleum Branch By-Laws that were adopted by the Branch Executive Committee on July 22, 1953. The reasons for the amendments are given. You are requested to review these amendments and vote your approval or disapproval. Please clip the ballot contained on this page, cast your vote on it, and mail it to the Branch Office by *September 10, 1953*.

Joe B. Alford
Executive Secretary

ARTICLE II — Members

Section 1. Any member of the AIME in good standing may become a member of this Branch by indicating in writing that he desires to receive the JOURNAL OF PETROLEUM TECHNOLOGY as that monthly publication that is to be furnished him at no charge in addition to his dues.

Amended as follows to clarify meaning of last phrase:

Section 1. Any member of the AIME in good standing may become a member of this Branch by indicating in writing that he desires to receive the Journal of Petroleum Technology as that monthly publication that is to be furnished him as part consideration for dues received.

ARTICLE IV — Meetings

Section 2. An open meeting of the Executive Committee of the Petroleum Branch shall be held during the annual meeting of the AIME, and special meetings may be called by the chairman.

Amended to clearly specify when open meetings of the Branch Executive Committee shall be held:

Section 2. An open meeting of the Petroleum Branch Executive Committee shall be held during the annual meeting of the AIME, and during any annual meeting of the Petroleum Branch. Special meetings may be called by the chairman.

ARTICLE V — Officers

Section 2. The Executive Committee shall consist of the following persons:

(a) The officers, and the immediate past chairman of the Branch, who shall all be elected;
(b) Six other elected members, who shall be elected, two each year for terms of three years;
(c) The Branch treasurer, who shall be appointed;
(d) One representative each from the Mineral Industries Education Division and the Mineral Economics Division, who shall be appointed.

Amended as follows to clarify meaning of parts (a) and (b):

Section 2. The Executive Committee of the Branch shall consist of the following persons:

(a) The officers, and the immediate past chairman of the Branch;
(b) Six other members, who shall be elected two each year for terms of three years;
(c) The Branch treasurer, who shall be appointed;
(d) One representative each from the Mineral Industries Education Division and the Mineral Economics Division of AIME, who shall be appointed.

ARTICLE IX — Nominations and Elections

Section 1. A nominating committee of five members shall be appointed by the Executive Committee during the Annual Meeting and submit its report to the chairman of the Branch not later than May 15.

Section 2. Any ten members of the Branch may submit nominations to the Executive Committee for one or more positions not later than August 15 and the members so nominated shall be included in the official ballot, providing only they meet the requirements of Article VIII.

Section 3. The voting shall be by letter ballot, electing three officers and two members of the Executive Committee annually.

Each nominatnig committeeman shall be advised at the time of his appointment that he is expected to solicit the advise fo the councils, executive committees or board of directors of such local sections as may be appropriate but that he is not to consider himself bound to observe such recommendations as may result.

BALLOT FOR BY-LAWS AMENDMENTS

Please clip out, complete, and mail to Petroleum Branch, AIME, 800 Fidelity Union Bldg., Dallas, Texas, by *September 10, 1953*.

ARTICLE	SECTION	VOTE ON PROPOSED AMENDMENTS	
II	1	Yes_____	No_____
IV	2	Yes_____	No_____
V	2	Yes_____	No_____
IX	1	Yes_____	No_____
IX	2	Yes_____	No_____
IX	3	Yes_____	No_____
IX	4	Yes_____	No_____
X	1	Yes_____	No_____
X	2	Yes_____	No_____

Name _____

Section 4. Section 3 shall apply only when any ten members take the action allowed under Section 2. When no such action is taken, the process for election shall be (1) that names and biographies of the nominating committee's designees shall be published in the June issue of JOURNAL OF PETROLEUM TECHNOLOGY, and upon August 15 the nominating committee's designees will be declared by the incumbent chairman to be automatically elected.

Amended as follows to state specifically when the Nominating Committee shall meet, and to improve the mechanics for conducting an election:

Section 1. A nominating committee of five members shall be appointed by the Executive Committee to meet during the Petroleum Branch fall meeting each year. Each nominating committeeman shall be advised at the time of his appointment that he is expected to solicit the advice of the councils, executive committees, or boards of directors of such local sections as may be appropriate.

Section 2. The nominating committee shall designate a nominee for the following Petroleum Branch officers: a Chairman and two Vice Chairmen who shall serve for one year, and two members of the Executive Committee who shall serve for three years. The nominating committee shall render its report to the incumbent Branch chairman by April 15 in the year following its appointment.

Section 3. The names and biographies of the nominating committee nominees shall be published in the May issue of Journal of Petroleum Technology each year. Any 10 members of the Petroleum Branch may submit additional nominations to the Executive Committee for one or more of the positions specified in Article IX, Section 2, providing only that the nominees meet the requirements of Article VIII. Such nominations shall be submitted not later than July 15 of each year, and the names and biographies of all nominees for the position concerned shall then be published in the August issue of Journal of Petroleum Technology, with equal space devoted to each.

Section 4. If additional nominations are not received by July 15, the incumbent chairman shall declare the nominating committee's nominees to be automatically elected. If additional nominations are received, a letter ballot showing all nominees for the positions concerned shall be sent to all Petroleum Branch Members, Associate Members and Junior Members in the United States, Canada, and Mexico, on or about September 1. The deadline for members to return the ballots shall be approximately 30 days after they are mailed. The incumbent chairman shall appoint a tally committee to count the ballots, and the nominees receiving the plurality of ballots for each position shall then be declared elected by the Executive Committee.

ARTICLE X — Amendments and Petitions

Section 1. Proposals to amend these By-laws shall be made in writing to the Executive Committee and signed by at least 25 members; or shall be made by a majority vote of the Executive Committee. Such proposals shall be published, with discussion, in JOURNAL OF PETROLEUM TECHNOLOGY as soon as they are prepared. If favored by a majority of the votes cast, the amendment shall become effective.

Section 2. Proposals to change the decisions, policy or procedures of the Executive Committee shall be made to it in writing and signed by at least 25 members. Such proposals, unless acceptable to the Executive Committee or withdrawn within 30 days, shall be published, with discussion in the following issue of JOURNAL OF PETROLEUM TECHNOLOGY and submitted to the members for vote within 60 days after publication. A majority of the votes cast shall be decisive.

Amended as follows to clarify intent of the by-law and improve the mechanics for amending the by-laws:

Section 1. Proposals to amend these By-laws may be made by 25 members by submitting the proposals in writing to the Executive Committee. Proposals for amendments may also be made by majority vote of the Executive Committee. Such proposals shall be published in Journal of Petroleum Technology as soon as they are prepared. Publication shall include appropriate discussion and a ballot on which members may vote. If it is deemed advisable by the Executive Committee, such proposals may be submitted to the membership in the form of a letter ballot within 120 days after their receipt or formation. The majority of votes cast by the membership on the proposals shall determine whether they shall be adopted or rejected.

Section 2. Proposals to change the decisions, policies or procedures of the Executive Committee shall be made to it in writing and signed by at least 25 members. Such proposals, unless acceptable to the Executive Committee or withdrawn within 30 days, shall be published with discussion and a ballot in the following issue of Journal of Petroleum Technology. If it is deemed advisable by the Executive Committee, such proposals may be submitted to the membership in the form of a letter ballot within 120 days after their receipt. The majority of votes cast by the membership on the proposals shall determine whether they shall be adopted or rejected.

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Proposed for Membership Petroleum Branch

Total AIME membership on Mar. 31, 1953, was 18,475; in addition 1,098 Student Associates were enrolled.

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The Institute desires to extend its privileges to every person to whom it can be of service, but does not desire as members persons who are unqualified. Institute members are urged to review this list as soon as possible and immediately to inform the Secretary's office if names of people are found who are known to be unqualified for AIME membership.

In the following list C/S means change of status; R, reinstatement; M, Member; J, Junior Member; A, Associate Member; S, Student Associate.

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Pasadena — Otis, Russell Morley (M).
Taft — Rochon, Jerry Arthur (J).

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LOUISIANA
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Shreveport — McLeod, Richard Royce (J).

MISSISSIPPI
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NEBRASKA
Omaha — Stahl, Gayle Edward (J).

NEW MEXICO
Farmington — Greer, Albert R. (R,A).

OKLAHOMA
Bartlesville — Burman, Lawrence Marvin (A).
Velma — Jaber, George Hinna (R,C/S-S-J).

TEXAS
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Bellaire — Attwell, Leonard Lycurgus, Jr. (J).
Corpus Christi — Ramsey, James Edwin (M).
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Old Ocean — Ferrell, Russell Ehrhardt (R,J).
Sinton — Biggs, Robert Tucker (A).
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Sweeny — Coleman, Jack Flowers (J).
West Columbia — McCann, William Robert (J).
Wichita Falls — McAlpine, Billie Joe (J).

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PERU
Lobitos via Talara — Garde-Hansen, Hans (J).

VENEZUELA
Lagunillas — Burgess, James Stanley (J).

Reserve Estimation

(Continued from Page 15, Section 1)

times the trend of the past performance of wells does not follow either of the two empirical types, but appears to change from one type that characterizes the flush production to the other type that characterizes the settled production. Clark presented an adaptation of the above two types of decline for the case in which a variable decline rate is indicated for a flush period and a constant decline is indicated for the settled period. He recommended that the production curve be plotted on a semilog paper and the reserves for an assumed flush production period be based on variable decline and the remaining reserves for the settled period up to the economic limit be based on constant decline. Details of this adaptation of types of declines to a production decline curve are further discussed in Clark's paper, lit. cited.

Conclusion

Clark pointed out that the recoverable reserve estimation on a property is based on the production history and is affected by the production methods in use, the rate of recovery, the cost of production, and the price of the oil. The estimate is periodically revised to take into account the changes in price of oil and operating costs that affect the economic limit; the changes in operating techniques and mechanical conditions of wells that affect the production rate; and the changes in reservoir conditions due to new discoveries, new zones, redrills and abandonments that affect the production decline curve. The reliability of the recoverable reserve estimation will depend on the care, experience, and judgment of the estimator; the application of trustworthy methods; and the length and reliability of the past production history.

Clark concluded his talk by emphasizing his conviction that the constant decline method gives the estimator better control than the variable decline method. He recommended that all production history data should be plotted on semilog paper, irrespective of the type of decline for the following reasons: (1) The estimator has visual indication of the rate of decline per year during the production history and can use his judgment whether or not the current rate of decline should be used for the balance of the life of the well. (2) The estimator is in a position to control, for the balance of the life of the well, the assumption (*i.e.*, amount of variation of decline over the balance of the life or the length of the remaining life) he may have to make with reference to the final decline rate.

AIME Members Tour California Fields

More than 200 members of the Pacific Petroleum Chapter of the American Institute of Mining and Metallurgical Engineers and their guests spent June 20 touring the oil fields around Newhall and Castaic Junction, an area which is contributing substantially to California's growing crude production.

During the all-day trip the 50-car caravan visited Honor Rancho, Castaic Hills, Oak Canyon, Del Valle, Castaic Junction, Placerita, Newhall-Tunnel area, Newhall-Potrero, and Pico Canyon. In addition, talks were given on other nearby fields, including Torrey Canyon, Oak Ridge, and the Tapo Canyon fields. The tour ended at Pico Canyon where a chuck-wagon barbecue was enjoyed at Standard Oil Co. of California's picnic grounds.

Hal Stanier, Sunray Oil Corp., headed the field trip committee. Other members were: Herm Schaller, McCullough Tool Co.; Russ Wade, Union Oil Co.; Kemp Barley, Baroid Sales Div.; and Chuck Evans, Schlumberger Well Surveying Corp.

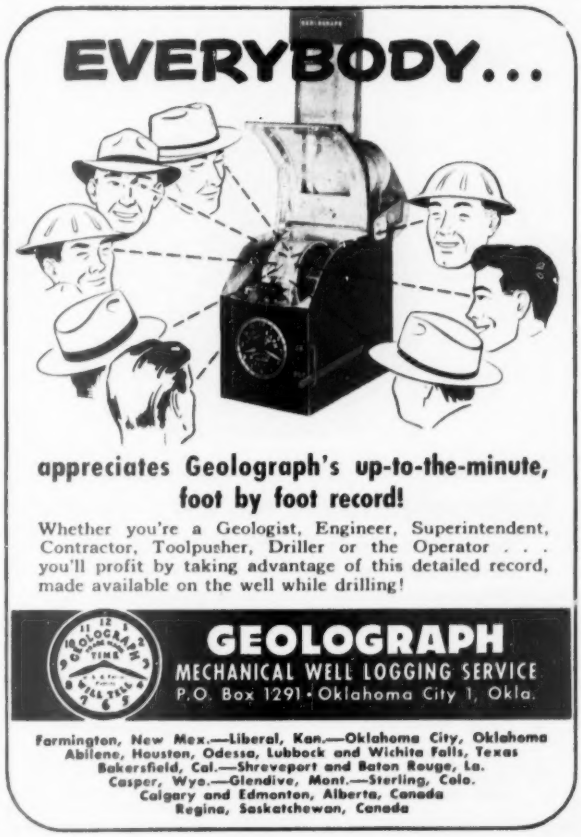
Speakers at the various stops were: R. F. Cory and Walter Kessler, The Texas Co.; Charles Ball, Richfield Oil Corp.; Hugh Barton, Humble Oil & Ref. Co.; O. C. Banning and Ellis Hamilton, Western Gulf Oil Co.; J. G. Troster and George Klingamen, Standard of California; W. O. Plant and A. J. Field, Union Oil Co.; George Patterson, Atlantic Oil Co.; J. E. Klipp, Sunray; C. L. Doyle, General Petroleum Corp.; and W. J. Scott, Pacific Western Oil Co.

Seventh Annual Fall Roundup Slated by Mid-Continent Section

The Mid-Continent Local Section of the AIME is planning its Seventh Annual Fall Roundup, to be held Sept. 11 on the grounds of J. N. McGirl's residence at Skiatook.

The Roundup traditionally opens the calendar of events for the Mid-Continent Section and provides an evening of entertainment, devoid of speech-making and formal program.

This year's Roundup is under the general chairmanship of H. D. Collins, petroleum consultant, and the following committee chairmen are laying plans for the event: Dave Wilson, grounds committee; Warren Davis, serving committee; Guy Williams, refreshment committee; M. B. Penn, food committee; R. A. Morse, entertainment committee; Frank Folger, games committee; F. H. Callaway, registration committee; S. F. Bird, transportation committee; A. W. Walker, student committee; J. N. McGirl, house committee.



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Death Takes Owen Thornton

Owen Fuller Thornton, 36, prominent petroleum engineer and AIME member, died in New Orleans, La., July 15, after a prolonged illness. Mr. Thornton had resided in New Orleans at 44 Wren St., since 1951. He was vice president of the Louisiana Land and Exploration Co.

Mr. Thornton was born in Wewoka, Okla., and received his technical training at Oklahoma A & M, where he received his bachelor and master's degrees. He was a member of Kappa Sigma fraternity. In Houston he was employed by the Tidewater and Texas Companies. In 1949 he served as Chairman of the Gulf Coast Section and in 1950 became Chairman of the Petroleum Branch Publications Committee.

He was a registered professional engineer, a member of the New Orleans Petroleum Club, AAPG member, and a member of the New Orleans Country Club. He was also a widely known author and speaker.

Mr. Thornton is survived by his widow, Howard Kolstad Thornton; three sons, Gardiner S., Peter K., and Owen F. Thorton, Jr.; two sisters, Mrs. Joe Saunders of Fort Worth, and Mrs. F. W. Lepaut of Pittsburgh, Pa.; and his mother, Mrs. Phillip Smith of Washington, D. C.

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B and W Incorporated . . . . . Sec. 1—5
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Theo. M. Martin Co. San Gabriel, Calif.

Baroid Sales Division . . . . . *
Brennan Advertising Agency, Houston

Byron Jackson Co. . . . . Sec. 1—16
Ruthrauff and Ryan, Hollywood, Calif.

Clark Bros. Co., Inc. . . . . *
Harold Warner Co., Buffalo N. Y.

Cooper-Bessemer Corp. . . . . Sec. 1-7
Griswold-Eshleman Co., Cleveland

Core Laboratories, Inc. . . . . *
Duvall Williams, Dallas

Dowell Incorporated . . . . . Sec. 1—8
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Eastman Oil Well Survey Co. . . . . Sec. 2—6
Ted Workman Advertising, Dallas

Garrett Oil Tools . . . . . *
W. L. Culver, Houston

Geograph Co., Inc. . . . . Sec. 2—7
Lowe Runkle Co., Oklahoma City

Geological Well Service Co. . . . . Sec. 2—5

Gulf Research and Development Co. . . . . *

Halliburton Oil Well Cementing Co. . Sec. 1—1, Sec. 1—14
Hill & Christopher, Los Angeles

Harbison-Fischer Mfg. Co. . . . . Sec. 2—3
Dan Goodrich, Dallas

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Ruthrauff & Ryan, Inc., Hollywood, Calif.

Johnston Testers, Inc. . . . . Sec. 1—4
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The McCarty Co., Los Angeles

Lane-Wells Co. . . . . Sec. 1—20
Darwin H. Clark Co., Los Angeles

Lufkin Foundry & Machine Co. . . . . Sec. 1—6
A. E. Cudlipp, Lufkin, Texas

Magnet Cove Barium Corp. . . . . Third Cover
Rives, Dyke & Co., Houston

McCullough Tool Co. . . . . Sec. 1—18
R. P. Casterline, Los Angeles

Mission Manufacturing Co. . . . . *
Rives, Dyke and Co., Houston

Moore, Lee C., Corp. . . . . *
Watts, Payne Advertising, Tulsa

Otis Pressure Control, Inc. . . . . Sec. 1—10
Dan Goodrich, Dallas

Professional Services . . . . . Sec. 2—2, 3

Reed Roller Bit Co. . . . . *
Brennan Advertising Agency, Houston

Ruska Instrument Corp. . . . . Sec. 2—8
Brennan Advertising Agency, Houston

Schlumberger Well Surveying Corp. . . . Second Cover
Rives, Dyke & Co., Houston

Second National Bank of Houston . . . . . *
Gano, Bachrodt, Edwards, Inc., Houston

United Geophysical Co., Inc. . . . . Fourth Cover
Dozier, Eastman and Co., Los Angeles

Welex Jet Services, Inc. . . . . Sec. 1—2
Evans & Associates, Fort Worth

Western Geophysical Co. . . . . *
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